

This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.

Author(s): Perkkilä, Päivi

Title: A Case of Four Prospective Adult Class Teachers' Mathematical Identity Work

Year: 2018

Version: Accepted version (Final draft)

Copyright: © 2018 Athens Institute For Education & Research

Rights: In Copyright

Rights url: <http://rightsstatements.org/page/InC/1.0/?language=en>

Please cite the original version:

Perkkilä, P. (2018). A Case of Four Prospective Adult Class Teachers' Mathematical Identity Work. In G. T. Papanikos (Ed.), ATINER's Conference Paper Series : EDU2017. [19th Annual International Conference on Education 15-18 May 2017, Athens, Greece] (pp. 1-18). Athens Institute for Education and Research. ATINER's Conference Paper Series, EDU2017-2356. <http://www.atiner.gr/papers/EDU2017-2356.pdf>

A case of four prospective adult class teachers' mathematical identity work

Perkkilä, Päivi
Senior Lecturer, Doctor of education
University of Jyväskylä
Kokkola University Consortium Chydenius,
PL 567, 67701 Kokkola
Finland
Tel. +358-7619623
E-mail: paivi.perkkila@chydenius.fi

Abstract

Research on adult students' the mathematical identity work has not been explored so much. In this study I try to understand four prospective adult class teachers' identity works on the basis of their learning diaries during a mathematics education course (6 ECTS). These four prospective class teachers' reported they had negative experiences of mathematics during their school years but later in their lives the views towards mathematics had changed to a positive direction. However, the identity work during the mathematics education course revealed that life experiences had not changed the most fundamental views towards mathematics, mathematics learning and teaching. During the mathematics education course, they began a healing re-building process of their mathematical views which gave them a better understanding to what learning and teaching goals to pursue in future.

Keywords: mathematical identity work, adult teacher training, learning diary.

Introduction

The aim of the study is to study is to understand four prospective adult class teachers' identity work as upcoming class teachers in mathematics from their school recollections and lifelong learning point of view. In this study a prospective adult primary teacher is an adult student who is changing her/his career to become a class teacher. She/he has former studies in education, some completed studies of the pedagogics and work experience in the teacher's profession. She/he might have a former profession such as subject teacher, kindergarten teacher or another profession but she/he do not has a qualification to act as a class teacher. The average age is about 33–39 years. Our education programme in Kokkola University Consortium Chydenius is particularly planned for those adults who are contemplating a change of career and those changing the emphasis of their studies in education. Depending on the agreed individual study plan the studies last for 2 to 2.5 years and lead to the degree of Master of Education and qualification as a class teacher.

There are amounts of reported research papers reported to conferences on adults' mathematics learning or adults' mathematics education generally which emphasize the importance of affect, emotions and feelings among

adult learners of mathematics (e.g. Schlögelmann, 2003; Evans, 2000, 2002). There is also research on adult's numeracy (e.g. Kaye, 2015) and adult's experiences of different learning environments (e.g. Larsen, 2015). Above-mentioned researches are written from the point of adult student and adult education but not from the point of adult teacher training. So the context of this research is very interesting as it places teacher education in the context of adult learning and affect (cf. Evans 2002, 2000).

During last few decades there has been a significant increase in studies that focus on identity in mathematics education. After 2000's, pre-service elementary teachers mathematics-related identity has studied e.g. Hodgen and Askew (2007); Jones, Brown, Hanley, and McNamara (2000); Lutovac and Kaasila (2011; 2014); Ma and Singer-Gabella (2011), Walshaw (2004). Above-mentioned researches have concentrated mainly on pre-service elementary teachers who have continued their studies in teacher education straight after the high school. Also in-service elementary mathematics-related teacher identity has been studied (e.g. Spillane, 2000; Drake, Spillane, & Hufferd-Ackles 2001). Most of the studies have used qualitative methodology, and there seems to be an expansion in the use of narrative and discursive methods. In this small-scaled qualitative research I am concentrating on four prospective adult class teachers' mathematical identity work. These four prospective adult class teachers have already another profession and they are changing their career to become a class teacher. Their age is between 35 to 53 years. They have also teaching experience. So they are adults who are studying in the teacher education.

Research has documented a rather negative picture of pre-service teachers' views of mathematics as a result of negative school-time experiences (f.ex. Di Martino & Sabena, 2011; Phelps, 2010; Kaasila 2007). According to Phelps (2010) pre-service class teachers have often high levels of mathematics anxiety, relatively low levels of mathematics achievement and conceptual understanding and are more likely than other students to hold negative picture about mathematics. So it is important to try to find ways to impact on prospective class teachers' views of mathematics. It is also crucial to describe the changes in prospective primary teachers' views of mathematics through mathematical identity work during teacher training.

Theoretical Viewpoints

Mathematical Identity Work

Wenger (1998) highlights four components of learning, namely: meaning, practice, community and identity. These four components structure a framework for a social theory of learning. Learning means to develop an identity through ways of participating with others in communities of practice. Identity is about how learning changes us who we are. It develops in our own minds and in the minds of others as we interact. Identity involves our knowledge and experiences, and also our perceptions of ourselves (e.g. beliefs, values, desires and motivations), others' perceptions of us and our perceptions of others. Bikner-Ahsbabs (2003) writes that mathematical identity can be seen as a construct that describes the relationship of a person

with mathematics. Overall, teacher identity, mathematical teacher identity, is seen as a construct which is changing over time and with a general consensus on its contextuality (Heyd-Metzuvanim, Lutovac & Kaasila, 2016). Research has highlighted that teachers' personal lived lives, such as those of being a learner, will shape and become a part of their teacher identities. Many researches (da Ponte, Oliveira & Varandas, 2002; Goos & Bennison 2008; Walshaw, 2004) has reported that there is a need to implement teacher identity construction in teacher training programs, for example in mathematics education courses, in ICT education, and particularly in teaching practicums. For example Hodgen and Askew have highlighted that emotions are in the center of learning to become a teacher of mathematics. According to Kaasila, Hannula, Laine and Pehkonen (2008) and Lutovac and Kaasila (2011; 2014), there is some evidence that if pre-service teachers have possibilities to narrate their own or listen to their peers' personal experiences with mathematics make them cope better and will lead to the more suitable identity for mathematics teaching. The so-called affective component of identity construction has been done especially with pre-service elementary teachers, who have experienced great difficulties with mathematics.

In this study prospective adult class teachers' mathematical identity is understood through those lived experiences by which they explain their relationship to mathematics and their mathematical lives (cf. Kaasila, 2007). During the teacher training they will have the mathematics education course (6 ECTS). During that course they have to write a reflective learning diary about their learning and experiences, their growing as a future teacher in mathematics in elementary school. When prospective adult class teachers are describing their mathematical experiences it involves reflection on, selection and arrangement of events which are meaningful for them and will convince the readers or listeners. By this kind of work prospective adult teachers are doing their mathematical identity work. (Watson, 2006.) Lutovac and Kaasila (2014, 2011) have conceptualized mathematical identity work describing mathematical identity work as a narrative process which gives prospective teachers strength to manage on new situations from point of their lived experience and strength to look to the future. According to Hassi and Laursen (2015) one's self-perceptions and interpretations of her/his experiences have an essential role in personal empowerment as a basis for identity development and capacity building. The development of mathematical identity is essentially connected to powerful experiences and interpretations of the self in mathematics performance situations. Self-perceptions can impact on positive or negative effects of previous mathematical achievements and experiences on one's future endeavors. (Hassi & Laursen, 2015.) Experiences have an essential meaning in developing one's view of mathematics.

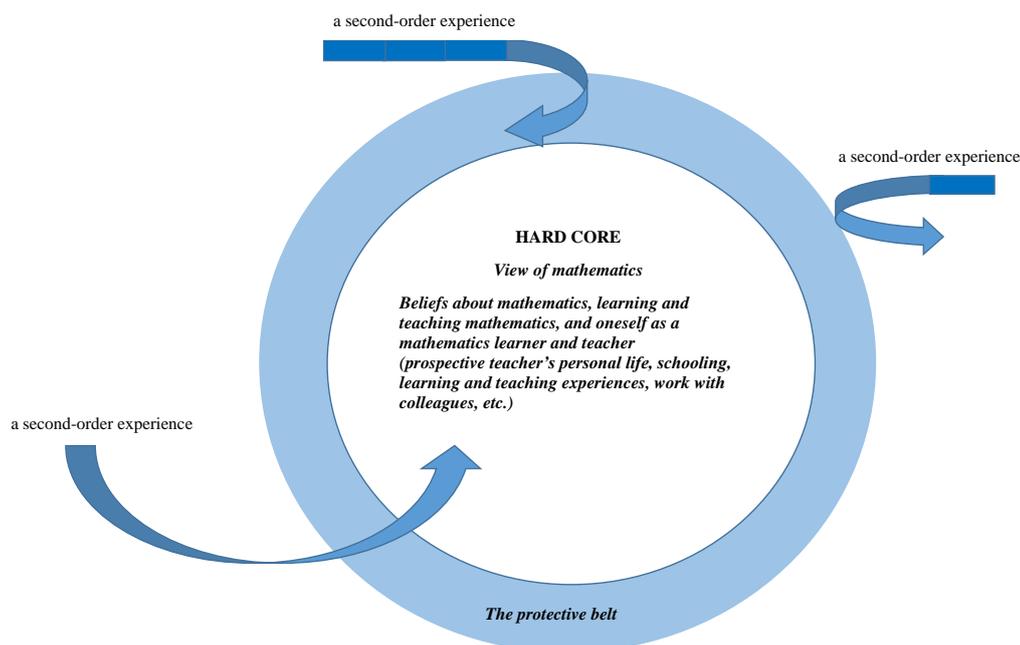
The View of Mathematics

The view of mathematics is understood as a wide set of learner's beliefs and conceptions which develops through experiences connected with mathematics in the interaction with affective, cognitive and conative factors.

Emotions, beliefs, conceptions and attitudes are working as regulating mechanism in the formation of the view of mathematics. Cognitive factors such as understanding, recognizing, estimating and reasoning are essential part of the learning process. To learn one needs to strive consciously to act and aim at something. (Op't Eynde, De Corte & Verschaffel, 2002)

The next figure (Figure 1) represents the view of mathematics. The hard contains the most fundamental views of mathematics, and in this research it contains prospective class teachers' most fundamental views of mathematics.

Figure 1. The view of mathematics (cf. Pietilä & Pehkonen, 2003; Op'tEynde, De Corte, & Verschaffel, 2002; Pietilä, 2002; Malinen, 2000)



According to Green (1971), the centrality of a belief reflects the strength of a belief system but also the connections with other beliefs. Other beliefs are consequences of a central belief and that is why they may be held. If the central belief changes it can have consequences for one's belief system. These changes may be very shaking for one's belief system. The beliefs in the hard core are relatively difficult to change. Around the hard core there is a protective belt which contains more flexible beliefs. Mathematics experiences act like second-order experiences which have to penetrate to the hard core through the protective belt in order to change the view of mathematics in an essential way (Pietilä, 2002). During the mathematics education course I try to involve prospective adult class active mathematical learning processes so that they could have strong positive learning experiences and empower themselves.

Methodology

The aim of this qualitative study is to understand four prospective primary teachers' identity work in a hermeneutic phenomenological framework

during mathematics education course. I addressed the following research questions:

1. What kind of experiences influence positively mathematical identity work of prospective adult class teachers' view of mathematics during mathematics education course?
2. How different pedagogical tools used in mathematics education course influence prospective class teachers' identity work?

Data Collection

The data consists of me and mathematics –essays written in the beginning of basic studies in mathematics, reflective learning diaries, and results of arithmetical surveying. In reflective ‘Me and Mathematics’ –essays, written in the beginning of mathematics education course, prospective adult class teachers described their mathematics learning in comprehensive school, mathematics teaching, the meaning of mathematics for themselves and their participation in social learning processes in the light of their past (see Kaasila, Hannula, Laine, & Pehkonen, 2008). For example Schoenfeld (1985) has written that when a student’s view of mathematics has developed through experiences, this will have an influence on her/his understanding, solutions, affective reactions and actions in mathematics-related situations. I understand that these adult pre-service class teachers’ view of mathematics has developed through their life-experiences which includes their experiences during their school-time, experiences during their former studies, experiences in working life and personal life. During writing ‘Me and Mathematics’ essays adult pre-service class teachers will do reflection, selection and arrangement of events which are meaningful for them (see Watson, 2006). These essays form me meaningful basis for understanding adult class teachers’ views of mathematics at the beginning of mathematics education course (6 ECTS). The essays gave me a tool to understand prospective adult class teachers’ reactions and anxiety when they heard that had to do a professional arithmetical calculation skills surveying a week afterwards writing the ‘Me and Mathematics’ essays. Also these essays gave me more understanding for the background of prospective adult class teachers’ results of the professional arithmetical calculation skills surveying. For example according to Hassi and Laursen (2016), weak confidence and a strong negative affect toward mathematics learning will have an effect on students’ poor mathematics achievement and participation, as against positive self-perceptions and behaviors such as increased perseverance, risk taking, and the use of improved cognitive and self-regulatory strategies are connected to efficient and deep learning. To pass the professional arithmetical calculation skills surveying prospective adult class teachers had to score 72 marks of full 90 marks. Approximately 30 % of the prospective adult class teachers have to retake the surveying in every mathematics education course (6 ECTS). During the mathematics education course prospective adult class teachers wrote reflective learning diaries. They described their reflective learning process and self-evaluation in the light of

their past and present mathematical experiences and their future as a mathematics teacher. The reflective learning diary consists of following parts:

1. *The first part:* Prospective adult class teachers should include the 'Me and Mathematics' essays as a starting point for the reflective learning diary.
2. *The second part:* Prospective adult class teachers should write narratives about the meaningful experiences (narratives about successful experiences and narratives about not so good experiences) during the course.
3. *The third part:* Prospective adult class teachers should write narratives about their mathematics teaching during the practicum.
4. *The fourth part:* Prospective adult class teachers should read two articles: one article about multiliteracy in mathematics education (Joutsenlahti & Kulju, 2015), and one article about mathematics learning difficulties (Huhtala & Laine, 2004). They had also to watch a video about the basis of dyscalculia (<http://www.arteveldehogeschool.be/dyscalculie/documentary>) On the basis of these articles and video prospective adult class teachers have to reflect their relationships to mathematics, teaching and learning.
5. *The fifth part:* At the end of the course prospective adult class teachers should write reflective syntheses about their individual reflective learning diary.

The prospective adult class teachers wrote the reflective learning diary in virtual web based learning environment where I could follow the progress of the reflective learning diaries in real time. The reflective learning diary gave me a mirror to look inside to my teaching but also it gave me tools to help prospective adult class teachers to improve their views of mathematics. As a course teacher it gave me tools to reflect my mathematics education course and my working methods, my actions as a teacher.

Mathematics Education Course

The mathematics education course (6 ECTS) aims to develop prospective adult class teachers' views of mathematics, mathematical thinking, and to open and explore the basic mathematical concepts and the methodological principles of teaching primary school mathematics. During the mathematics education course I use a lot peer interaction and communication as a tool for empowering prospective adult class teachers. Prospective adult pre-service teachers must manage social interaction such as presenting, arguing, and participating in common discussions. According to Hassi and Laursen (2016) these kind of situations can be significant moments for prospective adult class teachers' identity development around learning mathematics. The course also aims to enhance prospective adult class teacher's mathematical confidence in her/his mathematical ability, knowledge and

critical attitude towards school mathematics, student's self-evaluation. In addition to reflective learning diaries, the prospective adult class teachers also deepen and develop their mathematical understanding by exploring mathematical content by manipulatives. Collaborative work is emphasized. Prospective adult class teachers' social empowerment means the enhancement of prospective adult class teachers' social skills through mathematical learning and problem solving. According to Hassi and Laursen (2016), these skills reinforce prospective adult class teachers' personal empowerment directly and indirectly through cognitive empowerment and self-empowerment as seen in their positive sense of self and identity, enjoyment, and personality. During the first practicum, organized in the middle of the mathematics education course, the prospective adult class teachers will apply the knowledge from the course in practice. Those prospective adult class teachers, who fail the arithmetical calculation skills surveying, will get personal guidance and support on their mathematics learning in mathematics workshops (6 hours, 2 hours at a time).

Research Participants

I have collected data between years 2011-2015 on 190 adult pre-service primary teachers with relation to the development work during mathematics education course. For this paper I have purposively chosen 4 prospective class teachers as research participants. These 4 prospective class teachers participated in mathematics education course (6 ECTS) during the academic year 2015. These research participants were chosen as follows:

1. Participants have described in Me and Mathematics –essays having negative experiences of mathematics during comprehensive school, or previous studies and they have signs of negative view of mathematics.
2. Participants did not pass the arithmetical calculation skills surveying in the beginning of mathematics education course.
3. Participants are different-aged, and they are typical representatives of our prospective adult class teachers.

The selected cases are particularly information rich and the expressions in learning diaries are vivid and rich (Patton, 1990).

Participants' background – the four prospective adult class teachers

Satu was 35 years old kindergarten teacher who has teaching experience 6 years and 5 months from pre-school. During the time at school she began to think that she was too stupid to learn something as fabulous as mathematics: *“The role of mathematics has meant me a lot during my school-time. I have always been very good student, hard-working, diligent, and committed to schoolwork. I have saved a school notebook from the 1st grade in which my teacher had written ‘Satu needs remedial education in mathematics’. This sentence really started to identify and to stigmatize my entire school-time in the point of mathematics learning.”* When she worked as a pre-school teacher she felt that her attitudes and beliefs towards mathematics changed more positive. In spite of this positive change as a pre-school teacher, at the

beginning of mathematics education course (6 ECTS) her negative school-time memories came out. Satu failed in arithmetical calculation skills surveying and got only 49 out of 90 marks. She retook the surveying and failed again. Satu asked special counseling to her mathematical problems.

Marja was 53 years old master of arts, a music teacher, with 5 years, 4 months teaching experience from primary school and 3 years, 3 months teaching experience from other school levels. She had no experience of mathematics teaching. Her relationship to mathematics seemed to be rather neutral. She is impatient by nature and easily blames other when she has difficulties to learn. She thinks that children should learn everyday mathematics. Teacher's role is to get children to understand mathematics. Marja got from the first arithmetical calculation skills surveying 71 out of 90 marks. On the second time she got 83 out of 90 marks.

Nina was 41 years old kindergarten teacher with 5 months teaching experience from primary school. She has not taught mathematics in elementary school. Nina sees that "*mathematics is like a black hole in space. It is a mysterious and secret, scary, and infinite.*" Nina believes that her parents infected her their negative attitudes towards mathematics. At school Nina felt herself somehow resigned and scared, frustrated and angry because she felt that she could not do mathematics. Nowadays mathematics means for her everyday calculations and managing in life. She thinks that her negative school-time experiences helps her to see children's learning difficulties and to teach mathematics holistically. At the beginning of mathematics education course she was a bit nervous about her mathematics learning. On the first time she failed in arithmetical calculation skills surveying (69 out of 90 marks) but on the second time she passed surveying (83 marks out of 90 marks).

Eeva is 43 years old artisan who had 3 years and 9 months teaching experience primary school. Despite negative school-time experiences in mathematics she likes mathematics. In secondary school she felt that she had very weak skills in mathematics. She thinks that on the basis of her negative learning experiences she can see those pupils who need special support, as well as those who are weaker and slower pupils. She also thinks that mathematics learning is a process and one can learn mathematics everywhere. Eeva got from first arithmetical calculation skills surveying 68 out of 90 marks. When she retook the surveying her score was 77 out of 90 marks.

Data Analysis

I have applied van Manen's (1997) hermeneutic approach of phenomenology. The language of the essays and reflective learning diaries provides the means of the data. As a researcher I move in the 'hermeneutic circle', between part of the essays and learning diaries and the whole of these texts, to establish truth by prospective adult class teachers' mathematical identity work by interpreting these texts. This 'hermeneutic circle' means the process of understanding prospective adult class teachers' texts by reference to the individual essay and learning experiences described

in learning diary along with my understanding of each individual part, by further reference to the whole document. (cf. Sloan, & Bowe, 2014.)

Through this hermeneutic approach of phenomenology I found from learning diaries empowering issues which were seen in prospective adult class teachers' reflections in the form of positive self-perceptions, internal locus of control, enhanced cognitive and social skills, and thereby making mathematics learning more enjoyable and rewarding (cf. Hassi & Laurssen, 2015). Prospective adult class teachers also felt that practicum in the middle of the mathematics education course, and the support from the course teacher and their families gave them strength and helped them to change their view of mathematics to more positive direction. The articles and video had given them more understanding about their mathematics learning and teaching. I found also irresolute factors which were mainly connected to prospective adult class teachers' school-time memories about mathematics, their abilities to learn mathematics during the course and to teach mathematics.

Results

The empowering issues were the learning atmosphere, mathematics workshop, interaction in group work, active working methods, and social context including the support from their families. Due to the open learning atmosphere the prospective adult class teachers felt that it was easy to be oneself. Eeva describes the atmosphere "*Throughout the course of time it was easy to be yourself, with questions to be answered, with errors and all.*" Eeva wishes to convey the same kind of working climate and operational culture as a course teacher. The course teacher is a role-model for her (cf. Markus & Nurius, 1986). The prospective adult class teachers felt that the working methods have influenced their mathematic learning a lot and strengthened confidence in their mathematical abilities. Working in small groups and with manipulatives has opened them a different viewpoint to mathematics. They have understood that there are different ways how to teach mathematics. "*Today, after a lesson, I wonder how much I have received here from active working methods, co-operative learning and teaching in a group. Or rather, the fact that in many cases there is not just one right way to solve the problems. ...There are so many ways to think as learners in a class. This I have to take into account as a teacher, absolutely.*" (Marja) The also felt that the video and the two articles had given them more understanding about their own school-time learning processes but also more understanding about how to teach mathematics to children. Also mathematics workshop, for those failed in arithmetical calculation skills surveying, had given prospective adult class teachers strength to face their difficulties. Satu, who was afraid of mathematics, understood through mathematics workshop that "*she is not the only one in the world who doesn't understand mathematics so well*". Mathematics workshop encouraged her to do more work with mathematics to ensure her future as a teacher (cf. Phelps, 2010). The practicum in the middle of mathematics education course gave prospective adult class teachers courage

to teach mathematics to children. *"It was so nice see that children were working so eager with math tasks."*(Nina) Prospective adult class teachers appreciated the support and encouragement from the course teacher and their families. When Marja told her husband how interesting mathematics is, her amazed husband had said to her *"Are YOU telling me that mathematics is interesting!"* Marja: *"Yes, I, who always at school felt pain because I didn't remember the patterns and rules. I was so slow thinker. So the opinions are changing."* The support from prospective adult class teachers' families and friends plays an important role because prospective adult class teachers' can tell their family members about their feelings and experiences more openly than anyone else. Social support and the encouragement from prospective adult class teachers' families, peers and friends helped them to develop their learning goals (Cocks & Watt, 2004; Phelps 2010).

The irresolute factors that caused prospective adult class teachers feelings of qualm were arithmetical calculation skills surveying, mathematics teaching as a teacher, and their know-how in mathematics, abilities to learn mathematics, and exercises during the course. The surveying had brought in their minds school-time memories of failure in mathematics test situations: *"The arithmetical calculation skills surveying was terribly exciting experience. I was nervous beforehand ...Mathematics is still terrifying subject to me! During the surveying I was confused, I couldn't remember anything."* (Nina) Sometimes prospective adult class teachers felt that exercises were too difficult and challenging: *"I would like to have more time to solve these exercises with my small group. When I work alone I feel myself so stupid and unsure and I cannot ask anyone's help right away."*(Nina) Marja did not have any experience in mathematics teaching experience in elementary school. At the end of the course she worried about her mathematics teaching in future *"Now after the course I know that I can teach mathematics in my own way. Still there are lots questions: How to differentiate? How time I can give to learning? I know that I can learn from experience but there are also issues to find out."* I think that uncertainty may signal that Marja is struggling (Urzúa & Vásquez, 2008).

For the future prospective adult class teachers felt that mathematics course had given them confidence to mathematics learning and teaching. *"It is too bad that mathematics course will end now. I feel that I have experienced a grate change in myself and begun to realize something differently than before. I have got much more than I hoped for."* (Eeva) prospective adult class teachers' feelings towards mathematics had changed but still they were unsure about mathematics teaching. Marja was not afraid of mathematics but she knew that she had to learn mathematics more: *"I have begun to enjoy mathematics, especially functional tasks and problem-solving. I do not know yet if I can teach mathematics. It definitely requires a lot of work. .. During practicum I got more confidence to mathematics teaching. Now I am more confident to working with children as a teacher."* She felt that she needed to understand the content of mathematical issues in order to be able to teach it (cf. Phelps, 2010).

Conclusion

Adult's experiential learning is a re-construction process which modifies the adult's personal knowing of the world holistically. During mathematics education course prospective adult class teachers' personal views of mathematics, mathematics learning and teaching begun to change on the basis of their experiences. This gave support for former researches (e.g. Kaasila, Hannula, Laine & Pehkonen 2008; Lutovac & Kaasila 2011; 2014) concerning the evidence that if pre-service teachers have possibilities to narrate their own or listen to their peers' personal experiences with mathematics make them cope better and will lead to the more suitable identity for mathematics teaching. Prospective adult class teachers were in situations where they had to see mathematics in a different way. Their school-time memories and knowing about their mathematical abilities formed their personal experiential knowing which included both rigid and flexible parts. Rigid part formed a hard core which contained the most fundamental beliefs towards mathematics, mathematics learning and teaching. Around this hard core there were more flexible beliefs, as a protective belt. When prospective adult class teachers have negative mathematical learning experiences the protective belt acts like a territory, and inhibits them to face the hard core beliefs. The learning experiences during the mathematics education course were second-order experiences. Positive mathematical second-order experiences gave prospective adult class teachers hints on how change inadequate of parts of their personal experiential knowing, and how to modify the inadequate parts of their personal knowing. (cf. Malinen, 2000.) Those experiences which gave prospective adult class teachers hints on how to change their learning goals were experiences through which they had to reflect their past mathematical knowing and experiences and compare them to new. This kind of empowering issues were working methods, problem-based learning, learning atmosphere, social contexts, and support from course teacher, peers and families. Most important issue for prospective adult class teachers was that they felt themselves safe enough to express their ideas in learning situations. Even though when they felt themselves unsecure in arithmetical calculation skills surveying they knew that they will have time and place to practice mathematics in mathematics workshops. The reflective learning diary gave prospective class primary teachers place to observe their past and present experiences in the light of their leaning goals and goals as a mathematics teacher. The diary gave frames for prospective adult class teachers mathematical identity work through which they could better understand to what learning and teaching goals to pursue. As Hassi and Laursen (2015) have written one's self-perceptions and interpretations of her/his experiences have an essential role in personal empowerment as a basis for identity development and capacity building. The development of mathematical identity is essentially connected to powerful experiences and interpretations of the self in mathematics performance situations. Self-perceptions can impact on positive or negative effects of previous mathematical achievements and experiences on one's future endeavors. (Hassi & Laursen, 2015.) My understanding is that these prospective adult class teachers had

opportunities to reflect their powerful experiences through reflective learning diaries and gave them opportunities to personal empowerment as a basis for their identity development and capacity building. Their experiences had an essential meaning in developing their views of mathematics to more positive direction. I hope this process will continue after the teacher education.

Prospective adult class teacher's positive mathematical identity works requires a knowledgeable and active adult educator. (cf. Malinen, 2000.) Di Martino, Coppola, Mollo, Pacelli, and Sabena (2013) points out that teacher educators' role is a fundamental in supporting prospective adult class teachers' efforts to re-build their relationship towards mathematics, mathematics learning and teaching. "*As teachers' educators we have to motivate future teachers to take the first steps, as well as to encourage them after the unavoidable falls, guiding them with the hand, in order to make future teachers as confident as to decide to leave the hand and to walk alone.*" This kind of working with prospective adult class teachers has developed myself as a teacher and given a strength to develop mathematics education course on the basis of adults' learning (cf. Malinen, 2000). This process has empowered my teacher identity.

I understand the limitations of my cases concerning prospective adult class teachers' identity work, particularly because I considered only a few cases, all of whom had a negative school memories of mathematics. I also understand that these results are connected to our teacher education context. That is why I cannot generalize my findings to other teacher education contexts. Eventually, mathematical identity work is life long process, which is connected to one's development as mathematics learner and teacher. Mathematics education course, at its best, offers an important basis for that development work. To ensure that this development work will continue when prospective class teachers have finished their studies, the teacher education departments should offer these teachers continuing education to support their confidence as mathematics teachers. Also continuing research-processes concerning mathematics-related teacher identity must include in teachers' continuing education.

References

- Bikner-Ahsbahr, A. 2003. A social extension of a psychological interest theory. In *Proceedings PME 27* (Honolulu, Hawai'i – USA 2003), http://onlinedb.terc.edu/PME2003/PDF/RR_bikner-ashbahr.pdf
- Cocks, R. J., & Watt, H. M. G. 2004. Relationships among perceived competence, intrinsic value and mastery goal orientation in English and maths. *The Australian Educational Researcher*, 31, 2, 81–111.
- da Ponte, J., Oliveira, H., & Varandas, M. J. 2002. Development of pre-service mathematics teachers' professional knowledge and identity in working with information and communication technology. *Journal of Mathematics Teacher Education*, 5, 2, 93–115.

- Di Martino, P., Coppola, C., Mollo, M., Pacelli, T., & Sabena, C. 2013. Pre-service primary teachers' emotions: The math-redemption phenomenon. In *Proceedings of the 37th Conference of the International Group for the Psychology of Mathematics Education "Mathematics learning across the life span"* (Kiel, Germany July 28 to August 2, 2013). A. M. Lindmeier & A. Heinze, ,Eds., Vol. 2. PME, 225–232.
- Di Martino, P., & Sabena, C. 2011. Elementary pre-service teachers' emotions: *Current State of Research on Mathematical Beliefs XVI* (Tallin, Estonia June 26-29, 2010), K. Kislenko, Ed., Tallinn University of Applied Sciences, 89-105.
- Drake, C., Spillane, J. P. & Hufferd-Ackles, K. 2001. Storied identities: Teacher learning and subject-matter context. *Journal of Curriculum Studies* 33, 1, 1–23.
- Evans, J. 2002. Developing the Ideas of Affect and Emotions among Adult Learners. In *Numeracy for Empowerment and Democracy? Proceedings of – University Printing* 2002). L. Østergaard/ T. Wedege, Eds., ALM8, 88-96.
- Evans, J. 2000. *Adults` Mathematical Thinking and Emotions*. London, Routledge Falmer.
- Green, T. F. 1971. *The Activities of Teaching*. New York: McGraw-Hill.
- Goos, M. E., & Bennison, A. 2008. Developing a communal identity as beginning teachers of mathematics: Emergence of an online community of practice. *Journal of Mathematics Teacher Education*, 11, 1, 41–60.
- Hassi, M.-L., & Laursen, S. L. 2015. Transformative learning: Personal empowerment in learning mathematics. *Journal of Transformative Education*, 13, 4, 316-340. DOI: 10.1177/1541344615587111
- Heyd-Metzuyanım, E., Lutovac, S., & Kaasila, R. 2016. Indentity. In *Attitudes, Beliefs, Motivation and Identity in Mathematics Education. An Overview of the Field and Future Directions. ICME-13 Topical Surveys*. Kaiser, G., Ed., faculty of Education. University of Hamburg, 14–16. DOI 10.1007/978-3-319-32811-9
- Hodgen, J., & Askew, M. 2007. Emotion, identity, and teacher learning: Becoming a primary mathematics teacher. *Oxford Review of Education* 33, 4, 469–487.
- Huhtala, S., & Laine, A. 2004. "Matikka ei ole mun juttu" – Matematiikkavaikeuksien syntyminen ja niihin vaikuttaminen. *Matematiikka – näkökulmia opettamiseen ja oppimiseen*. Räsänen, P., Kupari, P., Ahonen, T., & Malinen, P. Eds. Jyväskylä: Niilo Mäki Instituutti, 320–346.
- Jones, L., Brown, T., Hanley, U., & McNamara, O. 2000. An enquiry into transitions: From being a 'learner of mathematics' to becoming a 'teacher of mathematics'. *Research in Education* 63, 1–10.
- Joutsenlahti, J., & Kulju, P. 2015. Kielentäminen matematiikan ja äidinkielen opetuksen kehittämisessä. *Monilukutaito kaikki kaikessa*. Kaartinen, T., Ed. Tampereen yliopiston normaalikoulu, 57–76.
- Kaasila, R. 2007. Using narrative inquiry for investigating the becoming of a mathematics teacher. *ZDM Mathematics Education*, 39, 205–213.
- Kaasila, R.; Hannula, M. S.; Laine, A., & Pehkonen, E. 2008. Socio-emotional orientations and teacher change. *Teaching and Teacher Education* 26, 854–62.
- Kaye, D. 2015. What do I teach? Mathematics, Numeracy, or Maths? In *Adults learning mathematics – inside and outside the classroom. Proceedings of the 21st International Conference of Adults Learning Mathematics: A Research*

- Forum* (Bern, Switzerland, June 29–July 2, 2014). A. H. Mason, & S. Beeli-Zimmerman, Eds., ALM, University of Bern, 141-149.
- Larsen, J. 2015. Adult Students' Experiences of a Flipped Mathematics Classroom. In *Adults learning mathematics – inside and outside the classroom. Proceedings of the 21st International Conference of Adults Learning Mathematics: A Research Forum* (Bern, Switzerland, June 29–July 2, 2014). A. H. Mason, & S. Beeli-Zimmerman, Eds., ALM, University of Bern, 155-170.
- Lutovac, S., & Kaasila, R. 2014. Pre-service teachers' future-oriented mathematical identity work. *Educational Studies in Mathematics*, 85, 129–142.
- Lutovac, S., & Kaasila, R. 2011. Beginning a pre-service teacher's mathematical identity work through narrative rehabilitation and bibliotherapy. *Teaching in Higher Education*, 16, 2, 225–236.
- Ma, J. Y. & Singer-Gabella, M. 2011. Learning to teach in the figured world of reform mathematics: Negotiating new models of identity. *Journal of Teacher Education* 62, 1, 8–22.
- Malinen, A. 2000. Towards the essence of adult's experiential learning. Reading the theories of Knowles, Kolb, Mezirow, Rewans and Schön. University of Jyväskylä. SoPhi.
- Markus, H., & Nurius, P. 1986. Possible selves. *American Psychologist*, 41, 954–969.
- Op 't Eynde, P., De Corte, E. & Verschaffel, L. 2002. Framing students' mathematics-related beliefs: A quest for conceptual clarity and a comprehensive categorization. In: *Beliefs: A hidden variable in mathematics education?* G. Leder, E. Pehkonen, & G. Törne, Eds., Dordrecht, Kluwer, 13–37.
- Patton, MQ. 1990. *Qualitative Evaluation and Research Methods* (2nd Edition). Newbury Park, CA: Sage Publications.
- Phelps, C. M. 2010. Factors that pre-service elementary teachers perceive as affecting their motivational profiles in mathematics. *Educational Studies in Mathematics*, 7,3, 293–309.
- Pietilä, A. 2002. The role of mathematics experiences in forming pre-service elementary teachers' views of mathematics. In *Proceedings of the PME 26, vol.4* (Norwich, United Kingdom 2002). A. Cockburn & E. Nardi, Eds.. Norwich, University of East Anglia, 57-64.
- Schlöglmann, W. 2003. Affect in mathematics education in light of neuroscientific results. In *Policies and practices for adults learning mathematics: opportunities and risks. Proceedings of the 9th International Conference of Adults Learning Mathematics* (Uxbridge, London, UK, 17-20 June 2002). J. Evans, P. Healy, D. Kaye, V. Seabright, & A. Tomlin, Eds., ALM9, London, King's College, 61-65.
- Schoenfeld, A. H. 1985. *Mathematical problem solving*. Orlando (FL): Academic Press.
- Sloan, A. & Bowe, Brian 2014. Phenomenology and hermeneutic phenomenology: the philosophy, the methodologies and using hermeneutic phenomenology to investigate lecturers' experiences of curriculum design. *Quality & Quantity*, 48, 3, 291-1303.
- Spillane, J. P. 2000. A fifth-grade teacher's reconstruction of mathematics and literacy teaching: Exploring interactions among identity, learning, and subject-matter. *Elementary School Journal* 100, 4, 307–330.
- Urzúa, A. & Vásquez, C. 2008. Reflection and professional identity in teachers' future-oriented discourse. *Teaching and Teacher Education*, 24, 1935–1946.

- van Manen, M. 1997. *Researching lived experience: human science for an action sensitive pedagogy*. 2nd edition. London, Ont.: Althouse Press.
- Walshaw, M. 2004. Pre-service mathematics teaching in the context of schools: An explanation into the constitution of identity. *Journal of Mathematics Education*, 7, 1, 63–86.
- Watson, C. 2006. Narratives of practice and the construction of identity in teaching. *Teachers and Teaching: Theory and Practice*, 12, 5, 509–526.
- Wenger, E. 1998. *Communities of Practice. Learning, meaning and identity*. Cambridge: Cambridge University Press.